OCCUPATIONAL SAFETY
AND HEALTH STANDARDS BOARD
2520 Venture Oaks, Suite 350
Sacramento, CA 95833
(916) 274-5721
FAX (916) 274-5743
www.dir.ca.gov/oshsb

NOTICE OF PROPOSED MODIFICATION TO

CALIFORNIA CODE OF REGULATIONS

TITLE 8: Chapter 4, Subchapter 7, Article 107, Section 5154.1 of the General Industry Safety Orders

Ventilation Requirements for Laboratory-Type Hood Operations

Pursuant to Government Code Section 11346.8(c), the Occupational Safety and Health Standards Board (Standards Board) gives notice of the opportunity to submit written comments on the above-named standard in which modifications are being considered as a result of public comments and/or Board staff consideration.

On September 15, 2005, the Standards Board held a Public Hearing to consider revisions to Title 8, Section 5154.1 of the General Industry Safety Orders. The Standards Board received comments on the proposed revisions. The standards have been modified as a result of these comments and Board consideration.

A copy of the full text of the standards as originally proposed, and a copy of the pages with the modifications clearly indicated, are attached for your information. In addition, a summary of all comments regarding the original proposal and staff responses is included.

Any written comments on these modifications must be received by 5:00 p.m. on May 9, 2006, at the Occupational Safety and Health Standards Board, 2520 Venture Oaks Way, Suite 350, Sacramento, California 95833. The standard will be scheduled for adoption at a future business meeting of the Standards Board.

The Standards Board's rulemaking files on the proposed action are open to public inspection Monday through Friday, from 8:00 a.m. to 4:30 p.m., at the Standards Board's office at 2520 Venture Oaks Way, Suite 350, Sacramento, California 95833.

Inquiries concerning the proposed changes may be directed to Keith Umemoto, Executive Officer at (916) 274-5721.

OCCUPATIONAL SAFETY AND HEALTH
STANDARDS BOARD

Date: April 18, 2006

Keith Umemoto, Executive Officer

STANDARDS AS ORIGINALLY PROPOSED

STANDARDS PRESENTATION
TO
CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

Amend Section 5154.1 to read:

§5154.1. Ventilation Requirements for Laboratory-Type Hood Operations.

* * * * *

(b) Definitions.

* * * * *

Hazardous Substance. One which by reason of being explosive, flammable, poisonous, an irritant, or otherwise harmful, is likely to cause injury or illness if not used with effective control methods.

Laboratory-Type Hood. A device enclosed except for necessary exhaust purposes on three sides and top and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user, and ~~in which~~ used to control exposure to hazardous substances ~~are used~~. These devices are also known as laboratory fume hoods.

(c) Ventilation Rates.

(1) Laboratory-type hood face velocities shall be sufficient to maintain an inward flow of air at all openings into the hood under operating conditions. The hood shall provide confinement of the possible hazards and protection of the employees for the work ~~which~~ that is performed. The exhaust system shall provide an average face velocity of at least 100 ~~linear~~ feet per minute with a minimum of 70 ~~l~~fpm at any point, except where more stringent special requirements are prescribed in other sections of the General Industry Safety Orders, such as Section 5209. The minimum velocity requirement excludes those measurements made within 1 inch of the perimeter of the work opening.

(2) When a laboratory-type hood is in use to contain airborne hazardous substances and no employee is in the immediate area of the hood opening, the ventilation rate may be reduced from the minimum average face velocity of at least 100 feet per minute to a minimum average face velocity of 60 feet per minute if the following conditions are met:

(A) The reduction in face velocity is controlled by an automatic system which does not require manual intervention. The automatic system shall increase the airflow to the flow required by (c)(1) when the hood is accessed.

(B) The laboratory-type hood has been tested at the reduced flow rate according to the tracer gas method specified in Section 7, Tracer Gas Test Procedure, of ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods, which is hereby incorporated by reference, and has a hood performance rating of 4.0 AU 0.1 or less. The test may be performed with or without the mannequin described in the ANSI/ASHRAE 110-1995 tracer gas method.

(C) The record of the most recent tracer gas test results and the “as used” test configuration shall be maintained as long as the automatic system is operable and thereafter for five years.

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

* * * * *

(e) Special Requirements.

(1) The face velocity required by subsection (c) should be obtainable with the movable sashes fully opened. Where the required velocity can only be obtained by partly closing the sash, the sash or jamb shall be marked to show the maximum opening at which the hood face velocity will meet the requirements of subsection (c). Any hood failing to meet the requirements of subsection (c) and this paragraph shall be considered deficient in airflow and shall be posted with placards, plainly visible, which prohibit use of hazardous substances within the hood.

(2) When flammable gases or liquids are used, or when combustible liquids are heated above their flashpoints, hoods ~~that are not bypassed shall have permanent stops installed which will restrict closure of the sash so that sufficient airflow is maintained to prevent explosions~~ shall be designed, constructed, and installed so that hood openings at all sash positions provide sufficient airflow to prevent ignitable concentrations. Concentrations in the duct shall not exceed 20% of the lower explosive limits.

(3) In addition to ~~requirements in~~ being tested as required by Section 5143(a)(5), ~~a means shall be provided at the~~ hoods shall meet the following requirements:

(A) By January 1, 2006, hoods shall be equipped with a quantitative airflow monitor that ~~to~~ continuously indicates whether ~~that~~ air is flowing into the exhaust system during operation. The quantitative airflow monitor shall measure either the exact rate of inward airflow or the relative amount of inward airflow. Examples of acceptable devices that measure the relative amount of inward airflow include: diaphragm pressure gauges, inclined manometers, and vane gauges. The requirement for a quantitative airflow monitor may also be met by an airflow alarm system if the system provides an audible or visual alarm when the airflow decreases to less than 80% of the airflow required by subsection (c).

(B) Qualitative airflow measurements that indicate t~~T~~he ability of the hood to maintain an inward airflow at all openings of the hood as required by subsection (c)(1) ~~above~~ shall be demonstrated using smoke tubes or other suitable qualitative methods ~~upon initial installation;~~. This demonstration shall be performed:

1. Upon initial installation;
2. On an annual basis;

EXCEPTION TO SUBSECTION (3)(B)2.: The frequency of the tests may be reduced to every two years if a calibration and maintenance program is in place for the quantitative airflow monitor or alarm system**.**

3. After repairs or renovations of the ~~facility,~~ hood or the ventilation system in that part of the facility where the hood is located; or
4. After the addition of large equipment into the hood.

* * * * *

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

(7) When perchloric acid is evaporated in laboratory-type hoods, the provisions of Section 5143(a)(4) shall apply. The materials of construction shall be ~~nonorganic (except for unplasticized polyvinyl chloride)~~ inert, smooth, and nonabsorbent. Organic polymers shall not be used except for inert fluoropolymers, such as polytetrafluoroethylene [PTFE] and tetrafluoroethylene-hexafluoropropylene copolymer [Teflon FEP], or similar nonreactive material. The hood and exhaust system shall be washed down with water for decontamination and prior to opening for maintenance.

EXCEPTION: Portable laboratory scrubbing apparatus for perchloric acid digestions may be used in lieu of the special requirements of this paragraph.

(f) Operator Qualifications. The employer shall ensure that employees who use laboratory-type hoods are trained to:

(1) Use the hood and its features safely;

(2) Determine the date of the last performance test and if the hood performance met the requirements of this section;

(3) Understand the general hood purpose, airflow characteristics, and potential for turbulent airflow and escape of hazardous substances from the hood; and,

(4) Know where the quantitative airflow monitor or alarm system is located on the hood and how it is used to indicate an inward airflow during hood operation.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

PROPOSED MODIFICATIONS
(Modifications are indicated in bold,
double underline wording for new language,
and bold, strikeout for deleted language.)

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

Amend Section 5154.1 to read:

§5154.1. Ventilation Requirements for Laboratory-Type Hood Operations.

* * * * *

(b) Definitions.

* * * * *

Hazardous Substance. One which by reason of being explosive, flammable, poisonous, an irritant, or otherwise harmful, is likely to cause injury or illness if not used with effective control methods.

Laboratory-Type Hood. A device enclosed except for necessary exhaust purposes on three sides and top and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user, and ~~in which~~ used to control exposure to hazardous substances ~~are used~~. These devices are also known as laboratory fume hoods.

(c) Ventilation Rates.

(1) Laboratory-type hood face velocities shall be sufficient to maintain an inward flow of air at all openings into the hood under operating conditions. The hood shall provide confinement of the possible hazards and protection of the employees for the work ~~which~~ that is performed. The exhaust system shall provide an average face velocity of at least 100 ~~linear~~ feet per minute with a minimum of 70 ~~l~~fpm at any point, except where more stringent special requirements are prescribed in other sections of the General Industry Safety Orders, such as Section 5209. The minimum velocity requirement excludes those measurements made within 1 inch of the perimeter of the work opening.

(2) When a laboratory-type hood is in use to contain airborne hazardous substances and no employee is in the immediate area of the hood opening, the ventilation rate may be reduced from the minimum average face velocity of at least 100 feet per minute to a minimum average face velocity of 60 feet per minute if the following conditions are met:

(A) The reduction in face velocity is controlled by an automatic system which does not require manual intervention. The automatic system shall increase the airflow to the flow required by (c)(1) when the hood is accessed.

(B) The laboratory-type hood has been tested at the reduced flow rate according to the tracer gas method specified in Section 7, Tracer Gas Test Procedure, of ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods, which is hereby incorporated by reference, and has a hood performance rating of 4.0 AU 0.1 or less. The test may be performed with or without the mannequin described in the ANSI/ASHRAE 110-1995 tracer gas method.

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

The tracer gas test need only be performed once per hood. However, if employers have chosen to perform the tracer gas test on subsequent occasions, it is the most recent record of test results and test configuration that shall be maintained pursuant to subsection (c)(2)(C).

(C) The record of the most recent tracer gas test results and the "as used" test configuration shall be maintained as long as the automatic system is operable and thereafter for five years.

* * * * *

(e) Special Requirements.

(1) The face velocity required by subsection (c) should be obtainable with the movable sashes fully opened. Where the required velocity can only be obtained by partly closing the sash, the sash or jamb shall be marked to show the maximum opening at which the hood face velocity will meet the requirements of subsection (c). Any hood failing to meet the requirements of subsection (c) and this paragraph shall be considered deficient in airflow and shall be posted with placards, plainly visible, which prohibit use of hazardous substances within the hood.

(2) When flammable gases or liquids are used, or when combustible liquids are heated above their flashpoints, hoods ~~that are not bypassed shall have permanent stops installed which will restrict closure of the sash so that sufficient airflow is maintained to prevent explosions~~ shall be designed, constructed, and installed so that hood openings at all sash positions provide sufficient airflow to prevent ignitable concentrations. Concentrations in the duct shall not exceed 20% of the lower explosive limits.

(3) In addition to ~~requirements in~~ being tested as required by Section 5143(a)(5), ~~a means shall be provided at the~~ hoods shall meet the following requirements:

(A) By January 1, ~~**2006**~~ **2008**, hoods shall be equipped with a quantitative airflow monitor that ~~to~~ continuously indicates whether ~~that~~ air is flowing into the exhaust system during operation. The quantitative airflow monitor shall measure either the exact rate of inward airflow or the relative amount of inward airflow. Examples of acceptable devices that measure the relative amount of inward airflow include: diaphragm pressure gauges, inclined manometers, and vane gauges. The requirement for a quantitative airflow monitor may also be met by an airflow alarm system if the system provides an audible or visual alarm when the airflow decreases to less than 80% of the airflow required by subsection (c).

(B) Qualitative airflow measurements that indicate t~~T~~he ability of the hood to maintain an inward airflow at all openings of the hood as required by subsection (c)(1) ~~above~~ shall be demonstrated using smoke tubes or other suitable qualitative methods ~~upon initial installation;~~. This demonstration shall be performed:

1. Upon initial installation;
2. On an annual basis;

PROPOSED STATE STANDARD,
TITLE 8, CHAPTER 4

EXCEPTION TO SUBSECTION (3)(B)2.: The frequency of the tests may be reduced to every two years if a calibration and maintenance program is in place for the quantitative airflow monitor or alarm system**.**

3. After repairs or renovations of the ~~facility,~~ hood or the ventilation system in that part of the facility where the hood is located; or

4. After the addition of large equipment into the hood.

* * * * *

(7) When perchloric acid is evaporated in laboratory-type hoods, the provisions of Section 5143(a)(4) shall apply. The materials of construction shall be ~~nonorganic (except for unplasticized polyvinyl chloride)~~ inert, smooth, and nonabsorbent. Organic polymers shall not be used except for inert fluoropolymers, such as polytetrafluoroethylene [PTFE] and tetrafluoroethylene-hexafluoropropylene copolymer [Teflon FEP], or similar nonreactive material. The hood and exhaust system shall be washed down with water for decontamination and prior to opening for maintenance.

EXCEPTION: Portable laboratory scrubbing apparatus for perchloric acid digestions may be used in lieu of the special requirements of this paragraph.

(f) Operator Qualifications. The employer shall ensure that employees who use laboratory-type hoods are trained to:

(1) Use the hood and its features safely;

(2) Determine the date of the last performance test and if the hood performance met the requirements of this section;

(3) Understand the general hood purpose, airflow characteristics, and potential for turbulent airflow and escape of hazardous substances from the hood; and,

(4) Know where the quantitative airflow monitor or alarm system is located on the hood and how it is used to indicate an inward airflow during hood operation.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

SUMMARY AND RESPONSE TO COMMENTS

SUMMARY AND RESPONSE TO WRITTEN AND ORAL COMMENTS

I. Written comments

Jon Zboralski, Director, Airflow Products, Fisher Hamilton, LLC by email dated August 16, 2005

Comments:

Allowing fume hoods to operate at 60 feet per minute (fpm) with the sash full open is a poor practice and a safety concern. The requirement to ASHRAE test is a step in the right direction but does not account for accidents in the hoods or drafts from activity in the surrounding laboratory. The change does not specify what type of hoods can be converted to the 60 fpm and certain older hoods will not be as successful in containment as newer models. The change to a quantitative from a qualitative alarm might preclude the use of stand alone low voltage solid state control devices utilizing thermistors to measure airflow. These devices are not part of the HVAC system and consist of a control panel mounted on the front of the hood with a tube to the inside of the device to measure airflow and give readout in terms of either face velocity or total exhaust.

Response:

The Board agrees that leaving the sash of a fume hood at the full open position is a poor practice. However, for the following reasons, the Board believes that the proposed changes ensure employee safety:

1) New subpart (f)(3) of the standard requires the operator to be trained to be aware of the effects of sash position on contaminant escape from the hood, and
2) Use of the ANSI/ASHRAE 110-1995 tracer gas test to qualify a hood for 60 fpm operation means that the performance of each hood must be characterized for the design opening. The ANSI/ASHRAE 110-1995 document also explicitly encourages that the test be conducted as well with the hood fully open in order to test potential conditions of misuse.

Regarding the comment about the use of existing thermistor devices to meet the quantitative requirements, such devices are acceptable as described since they give a continuous measurable indication of inward airflow. Therefore the Board does not see a need to modify subsection (e)(3)(A) in response to the comment about existing thermistor type control devices.

The Board thanks Mr. Zboralski for his participation in the Board's rulemaking process and his support of the general direction of the proposed standard.

Elizabeth A. Treanor, Director, Phylmar Regulatory Roundtable, by letter dated September 6, 2005

Comments:

Phylmar Regulatory Roundtable (PRR) supports most of the proposed amendments to Title 8, Section 5154.1, specifically, the proposed subsection changes regarding: Quantitative Airflow Monitor [(e)(3)(A)], Qualitative Airflow Measurements [(e)(3)(B)], and Operator Qualifications [(f)]. PRR also supports the proposed changes to subsection (c)(2) as they relate to the

requirements for an automatic system to detect operator presence and the requirements for utilization of the tracer gas test in the ANSI/ASHRAE 110-1995 method.

However, PRR is concerned that the proposed language in subsection (c)(2)(B) does not require the tracer gas tests be repeated. The following addition to the standard to cover circumstances of concern is proposed: "The tracer gas test shall be repeated whenever the following occur: change in operating conditions, significant maintenance that may affect the flow rate of the hood, a change in facility design or pressure in the hood, or any other event that may result in a change in the flow rate of the hood."

Also, in regard to proposed subsection (e)(2)(C), there is inadequate justification for the requirement to keep records of tracer gas tests for five years after the automatic airflow system is no longer operable. If records are to be kept, the time period should be reduced to three years, similar to the requirements of Section 3203.

Response:
The Board recognizes that PRR's motivation for the suggested change to subsection (c)(2)(B) is to assure employee safety, however the Board believes the additional language is unnecessary. The proposed language requires employers to follow the method of ANSI/ASHRAE 110-1995 to establish an "as used" performance rating for any hood to be operated at the 60 fpm rate in the absence of the operator. The concept of an initial "as used" performance rating includes consideration of all the parameters listed in PRR's suggestion. The laboratory and hood parameters that exist during the running of the tracer gas test can serve as part of the record and serve as a future point of comparison, like a baseline. If an employer later detects significant hood flow changes that cannot be otherwise corrected, the employer can choose to do one of the following:

- utilize the existing performance rating as a reference to evaluate if it is necessary or warranted to restore laboratory conditions to the original;.
- end operation at the 60 fpm unattended mode;
- perform a new tracer gas test to establish a new point of comparison.

The purpose of the addition of subsection (c)(2) is to establish a minimum requirement that will provide a reduced ventilation rate while not compromising the ability of the laboratory-type hood to contain the hazardous substances in the hood. A one-time use of the tracer gas method establishes both the capability of a particular hood to operate at 60 fpm in the unattended mode and the particular ambient parameters in which this is possible. Neither the ANSI/ASHRAE 110-1995 method nor any scientific evidence submitted during the regulatory process have suggested that it is necessary or required to repeat the tracer gas test.

While, as PRR suggests, the ANSI/ASHRAE 110-1995 test recognizes that there are circumstances in which lab hood users may wish to repeat the tracer gas test, the Board concludes it is sufficient to require only the single tracer gas test. However, since it is foreseeable that hood users may opt to repeat the tracer gas test, it is necessary to allude to that possibility in the proposed standard so as to ensure that the most recent tracer gas test record is maintained. The Board agrees that employee safety must be ensured but notes that new subsection (e)(3) addresses employee protection concerns by requiring employers to regularly

evaluate the functioning of their laboratory fume hoods. By requiring the employer to utilize additional qualitative airflow measurements when changes like those suggested by PRR occur in operating conditions, subsection (e)(3) ensures that malfunctioning hoods will be detected.

The Board acknowledges that the reference in the proposal to additional tracer gas tests may cause confusion as to the number of the tests actually required. Therefore, the Board proposes to add additional wording clarifying that a tracer gas test is required to be performed once per hood. However, if employers have chosen to perform the tracer gas test on subsequent occasions, it is the most recent record of test results and test configuration that shall be maintained.

In regard to the need for maintenance of tracer gas test results for five years after a hood is inoperable, the Board relied on the record keeping requirements of Section 5143(a)(5) as the rationale for this requirement. Section 5143(a)(5) continues to apply to records for other types of mechanical exhaust ventilation. The Division has concluded that the question of whether or not a shorter record retention period (such as three years) is appropriate for decommissioned laboratory hoods is a matter that would need to be given considerable further evaluation within the context of Section 5143 and perhaps other standards. Therefore, the Board declines at this time to reduce the record retention period below the five years proposed in this rulemaking.

The Board thanks Ms. Treanor for her participation in the Board's rulemaking process.

Robert K. Haugen, Technological Director, Fume Hood Systems, Kewaunee Scientific Corporation, by letter dated September 7, 2005
Comments:
Kewaunee Scientific Corporation supports the change from the current 100 fpm, but believes that proposed section (c)(2) would limit compliant systems to those with variable air volume capability even though low constant volume systems can be just as safe and should not be precluded.

Response:
The Board agrees with Mr. Haugen's conclusion that laboratory hoods incapable of operation at 100 fpm in the occupied mode will continue to be noncompliant in California.

However, the Board does not believe it has been established that hood operation at low volumes is safe. No consensus about the safety of low constant volume systems was reached during this public rulemaking process or the advisory process that preceded it.

The Board thanks Mr. Haugen for his participation in the Board's rulemaking process.

John L. Bobis, P.E., Ph.D., Technical Principal, Aerojet, by letter dated September 8, 2005
Comments:
Aerojet's quarterly proactive maintenance on its more than 100 hoods ensures optimal hood performance without the need to implement quantitative flow monitoring devices. The installation costs of such devices will be two to three times greater than the Board's estimate, and the Board's estimate does not account for production down time during installation. Due to the nature of the work at Aerojet, installation of the devices on some of its hoods would require more expensive explosion proof meters so that, on average, installation of the devices would cost

$2,000 per hood. The total cost to Aerojet is too high a percentage of the total statewide costs, and the standard "could unduly interfere with interstate commerce" by causing Aerojet to bear such costs.

Mr. Bobis suggested that only new laboratory hoods or those hoods that had had a major modification should be subjected to the requirement of proposed section (e)(3)(A) for a quantitative flow monitor.

Aerojet supports the elimination of the requirement for permanent mechanical stops for hood sash closure in new proposed subsection (e)(2) but recommends changing the proposed language, "be designed, constructed, and installed so that hood openings at all sash positions provide sufficient airflow to prevent ignitable concentrations" to "be designed, constructed, and installed and used with flammable materials so that openings at all sash positions provide sufficient airflow to prevent ignitable concentrations." This revision would acknowledge that it is often possible to control flammable concentrations of materials in a hood by minimizing the rate and duration of flammable material release within the hood.

Response:
The Board acknowledges that certain employers may incur greater average costs than others when installing the quantitative airflow monitors. However, the Board believes that the costs, would still be relatively insignificant compared to the costs associated with operating and maintaining a hood. Aerojet and other employers could offset this cost by taking advantage of the automated airflow control system the proposal allows.

The Board does not agree that existing hoods should be subject to an exemption from the requirement for a quantitative airflow monitor. The addition of the quantitative monitor provides additional safety to hood operators by alerting them to potentially dangerous airflow changes in between periodic hood maintenance and assessment; existing qualitative flow indicators can fail to give that indication. The Board believes it would be inadvisable to exclude, for an indefinite period of time, some hood operators from the additional protections afforded by the proposed quantitative airflow monitor requirement.

Finally, the Board does not believe the alternative language proposed by Aerojet for subsection (e)(2) is necessary. The purpose of subsection (e)(2) is to ensure that design and installation considerations of hoods in which flammable or combustible material may be used have sufficient airflow to prevent ignition even at the new minimum flow rate of 60 fpm. Aspects of safe use of hoods can be adequately addressed through the operator training required by proposed new subsection (f). This language is sufficiently broad to encompass Aerojet's technical point that there are ways to control concentration of flammable materials other than by airflow rate alone.

The Board thanks Mr. Bobis for his participation in the Board's rulemaking process.

Barry Foose, EH&S Specialist, Kaiser Western EH&S Hub, Kaiser Permanente Health Care Systems by letter dated September 9, 2005
Comments:
Kaiser Health Care Systems has approximately 140 older fume hoods that would need to have quantitative airflow monitors installed. Two contractors have given Kaiser an estimate of $600

for the monitors and $500 for necessary electrical work to bring these fume hoods into compliance with the proposal, yielding a total compliance cost to Kaiser of $154,000.

Ductless air filtering hoods should be excluded from the quantitative airflow monitor requirement because they are not currently designed with quantitative alarms, and qualitative indicators of performance together with industrial hygiene monitoring should be adequate for such hoods.

Response:
The Board acknowledges that some employers may incur greater than average costs than others when installing the quantitative airflow monitors. The Board believes that the costs would still be relatively insignificant compared to the overall costs associated with operating and maintaining a hood. It is important to note that the proposed requirement lists a variety of acceptable devices, all of which have different advantages and features, and costs can be considered in making decisions on which features to select. Some compliant devices are not electrical, and use of them does not require electrical work.

The Board believes it would be unwise to exclude ductless fume hoods from the requirement for quantitative monitors. Leading manufacturers currently market ductless fume hoods that are compliant with this new requirement. The Division has determined that aftermarket devices which can be utilized in any older hood, regardless of the manufacturer, are available.

The Board thanks Mr. Foose for his participation in the Board's rulemaking process.

Jon Archenhold, Tek-Air Systems, by letter received on September 15, 2005
Comments:
Mr. Archenhold believes that the estimate of energy savings might be inflated because it assumes a fully open sash position while good practice would induce an operator to lower the sash. Savings would be negligible at fully lowered positions.

The lower flow rate permitted by the proposed changes could allow a nearby hood to draw fumes from the so-called setback hood into the laboratory environment.

Hood manufacturers are concerned that older hoods will be operated at 60 fpm with the sash fully open.

The occupancy sensor that would be required under proposed subsection (c)(2)(A) has already been installed at many installations in California.

Response:
While the Board acknowledges that many variables may affect the amount of energy savings that a particular employer experiences, the Board feels there is ample evidence that considerable energy savings will accrue to fume hood users that opt to reduce the airflow to 60 fpm during times the operator is not present. Significantly lesser amounts of conditioned air flow into a hood operating at 60 fpm than into one operating at 100 fpm—regardless of sash position.

Proposed subsection (c)(2)(B) requires the "as used" configuration for the ANSI/ASHRAE 110-1995 test. This means that a particular hood cannot pass at the 60 fpm rate if any nearby hoods draw fumes from the hood being tested. The Board believes the hazards described by Mr. Archenhold (and any similar hazards stemming from limitations of older hoods' performance capabilities) are precluded by the testing method.

When proposed subsection(c)(2) becomes effective, any hood that currently has occupancy sensors can utilize these devices if it meets the new requirements.

The Board thanks Mr. Archenhold for his participation in the Board's rulemaking process.

Lawrence M. Gibbs, CIH, Associate Vice Provost, Environmental Health and Safety, Stanford University by letter dated September 15, 2005

Comments

The applicability and frequency of the ANSI/ASHRAE 110-1995 tracer gas test is not clearly stated in the proposed language. The test should be primarily utilized for new hood installations so that large research organizations will not be required to make significant resource investments to comply. Significant personal exposures do not occur with existing hoods subject to existing monitoring and evaluation protocols. Therefore, Stanford University recommends that the proposed standard requiring utilization of the ANSI/ASHRAE 110-1995 test be restricted to installation of new airflow control systems only. Stanford University agrees with utilizing ANSI/ASHRAE 110-1995 for new installations but not for periodic evaluation.

Stanford University additionally recommends that for new installations of ten or more hoods, employers should be allowed to apply the ANSI/ASHRAE 110-1995 test to only a representative number of hoods within a facility "of the same type/location/use." This test is "resource intensive," and representative testing provides a lower cost equivalent level of protection and assurance with lower cost.

Response:

It is important to note that the proposed requirement to utilize the ANSI/ASHRAE 110-1995 tracer gas test does not call for routine periodic testing. The ANSI/ASHRAE 110-1995 method allows the establishment of a particular performance rating for each hood in its unique "as used" environment.

Utilizing the ANSI/ASHRAE 110-1995 tracer gas test becomes an employer responsibility in the first place only if the employer chooses the option of operating unattended hoods at the 60 fpm lower rate. The purpose of allowing this option is to gain the benefits of energy savings from the lower operating rate. The Board believes these savings more than offset the compliance costs.

Stanford University's proposal to limit the ANSI/ASHRAE 110-1995 tracer gas test to new installations would not afford adequate operator protection. The Board believes that representative testing cannot serve as a reliable substitute for testing each hood individually. This approach would be inconsistent with the reliance of the testing method on the establishment of individual hood "as used" parameters. In addition, there was concern expressed during the Advisory Committee process that statistical modeling of representative hood sampling indicated that hood failures were likely to be missed.

The Board thanks Mr. Gibbs for his participation in the Board's rulemaking process.

II. Oral Comments

Elizabeth A. Treanor, representing Phylmar Regulatory Roundtable (PRR)
Comment:
PRR supports most of the proposed changes and reiterates the points made in their letter of September 6, 2005, the substance of which is described above.

Response:
The Board thanks Ms. Treanor for her comments and participation in the Board's rulemaking process. The Board has previously addressed these issues in the section on written comments.

Ken Smith, retired from CA Department of Health Services Richmond Labs
Comment:
The 60 fpm airflow allowed by the proposal is too low because air currents can disrupt hood containment. While such low velocity hoods save money and energy, the hoods could release hazardous materials in an earthquake. To eliminate the hazard, the phrase "storage of hazardous materials" should be stricken from the standard.

The Department of Health Services Lab experience has been that significant airflow change occurs in hoods in as little as six months, due to conditions like belt loosening. Therefore**,** Mr. Smith was opposed to the proposed biannual exception to the requirement of Section (e)(3)(B)(2) for annual qualitative airflow measurements where employers have adopted the 60 fpm option.

Response:
The Board notes that the ANSI/ASHRAE 110-1995 tracer gas method of testing in "as used" conditions would detect and account for existing laboratory air currents. As for the possibility of earthquakes spilling hazardous materials stored in a hood, the Board notes that the possibility of an accidental spill within a hood has always been a reality. The lowered flow rate of 60 fpm may influence the planning and training that hood operators must do regarding potential accidents, but it is not a sufficient reason for the Board to consider disallowing the storage of hazardous materials in hoods with lowered flow rates. Title 8 Section 5154.1 (Ventilation Requirements for Laboratory Hood Operations) has always had the purpose of ensuring safety for hood operators during conditions of operation, not necessarily during conditions during an accident. Additionally, post earthquake evaluation of hood operations should be the order of the day under the existing standard just as much as under the proposed revised standard.

Although the Board agrees with Mr. Smith that hood functioning can deteriorate quickly, the Board does not agree that the proposed exception to the (e)(3)(B)(2) annual qualitative hood evaluation should be altered. Under the proposal, the exception is only available if a calibration and maintenance program is in place for the quantitative airflow monitors or alarms. Such a program will detect the airflow changes of concern to Mr. Smith.

The Board thanks Mr. Smith for his comments and participation in the Board's rulemaking process.

Dr. Morie Oberg, representing CA Department of Health Services Richmond Labs
Comments:
The 60 fpm option is not advisable. Every laboratory is different, while the proposal is a one-size-fits-all approach. Those who wish to use hoods at 60 fpm should utilize the variance process. There is nothing in the proposed standard that describes the equipment or method for airflow measurement.

Response:
The Board does not believe that the proposal constitutes a one-size-fits-all approach. The ANSI/ASHRAE 110-1995 tracer gas method results in a unique "as used" performance rating for each hood. The ANSI/ASHRAE 110-1995 tracer gas method is incorporated by reference and it adequately describes the equipment and method for airflow measurement.

The Board thanks Dr. Oberg for his comments and participation in the Board's rulemaking process.

Richard Yardley, representing Newmatic Engineering
Comments:
Mr. Yardley, who was the original petitioner for these changes, supports the proposal. The advisory committee that met has satisfactorily addressed the issues surrounding the use of 60 fpm in hoods.

Response:
The Board thanks Mr. Yardley for his comments, support and participation in the Board's rulemaking process.

Martin Burke, representing Technical Safety Services
Comments:
Mr. Burke has tested over 1,000 hoods using the ANSI/ASHRAE 110-1995 tracer gas method. The proposed changes that provide for the use of this method without a mannequin placed in front of the hood during the test make the ANSI/ASHRAE 110-1995 protocol meaningless. There is insufficient detail in the proposal on how to perform airflow velocity testing which should be added to the standard before it is adopted.

Response:
The reason that the mannequin is omitted from the test procedure proposed for this standard is that ANSI/ASHRAE 110-1995 is being used to establish an "as used" configuration for hoods in which the 60 fpm airflow rate is only permitted when no hood operator is present. Therefore, for California purposes, having the mannequin present for the ANSI/ASHRAE 110-1995 test would misrepresent the actual "as used" conditions. The ANSI/ASHRAE 110-1995 tracer gas method allows the fume hood to operate at the reduced flow rate of 60 fpm. Under the proposed changes to Section 5154.1, hood operation in California must still be conducted at the minimum average face velocity of 100 feet per minute with the operator present, as stated in subsection(c)(1). Proposed subsection (c)(2) specifically states the reduced flow rate may be utilized "when no

employee is in the immediate area of the hood opening." For these reasons, the Board believes it is not necessary to provide a mannequin for the ANSI/ASHRAE 110.

The Board believes that it is not necessary to provide a detailed description of how to perform airflow monitoring, since ANSI/ASHRAE 110-1995 and other consensus standards adequately describe the practice.

The Board thanks Mr. Burke for his comments and participation in the Board's rulemaking process.

Jon Archenhold, representing Tek-Air Systems
Comments:
See comments by Mr. Archenhold as described under the "written comments" section.

Response:
Please see the Board's response as described under the "written comments" section.

Dialogue between Karl Aveard, representing Syskd Hennesy, and Robert Harrison, Board Member at the September 15, 2005 Public Hearing
Comment:
Mr. Aveard has tested thousands of hoods in 30 years in the business. He supports the proposed standard and supports the use of non-attended hoods operating at 60 fpm but not attended hoods. Many outside sources of air movement in the lab affect the hood flow rate, but these are addressed by the ANSI Z9.5 standard and do not have to be in this standard. It is important for the outside variables to be considered by engineers designing laboratories.

Question No 1:
Board Member Harrison asked if there is good evidence of hood containment at the 60 fpm level in an unoccupied room.

Reply:
Mr. Aveard stated that hood containment was a reasonable expectation for an unoccupied room but that in a room in which engineers had not taken outside sources of air movement into account, 60 fpm could be a dangerous level.

Question No 2:
Board Member Harrison sought clarification as to why Mr. Aveard believed 60 fpm could be a dangerous level if Mr. Aveard supported the proposed changes before the Board.

Reply:
Mr. Aveard does support the proposal but wishes to point out that containment within the hood cavity is of primary importance. If this is not taken into account, extraneous impact such as operator movement could cause the loss of containment. This could happen with poor design at 100 fpm hoods as well. All over the country hoods are operating at the 60 fpm rate and containing very well and therefore, there is no problem with the standard as written for unoccupied fume hoods.

Response:
The Board thanks Mr. Aveard for his support, comments and his participation in the Board's rulemaking process.

Dialogue between members of the Board with Len Welsh, Acting Chief of the Division of Occupational Safety and Health and Steve Smith, DOSH Research and Standards Supervising Industrial Hygienist at the September 15, 2005 Public Hearing

Question No 3:
Board Chair Steve Rank asked Steve Smith about the rationale for the requirement [in subsection (c)(2)(C)] of a five-year retention of the most recent tracer gas test results versus a three-year period.

Reply:
The five-year requirement was consistent with the five-year retention of ventilation records required by existing standard Section 5143.

Question No 5:
Board Member Harrison asked Steve Smith what could be done about referencing the latest ASHRAE standard instead of specifying a dated standard, since, for example, the ANSI/ASHRAE 110 standard is to be reissued this year.

Reply:
California's standards setting procedures essentially prohibit the automatic incorporation of the latest editions of consensus standards such as ASHRAE and ANSI into California standards. In order for a California standard to require compliance with the latest edition of a consensus standard, a public comment period would be required every time a new edition of the consensus standard was published.

Question No 6:
Board Member Navarro asked about the reasoning behind having a five or a three-year record retention period.

Reply:
Steve Smith stated that it was to give the public consistent record keeping requirements. Len Welsh stated that the Division would give further consideration to the issue of retaining records after a laboratory hood system is no longer operable.

In reviewing the rulemaking record for similar 5-year record retention requirements in Sections 5142 and 5143, the Board finds that such a period is necessary to be consistent with records retained for other ventilation systems including the HVAC system that would be affected by changes in a lab hood's ventilation system.